8. On Races and Hybrids among the Salmonidæ.—Part IV.

By Francis Day.

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In continuation of the series of papers upon "Races and Hybrids among the Salmonidæ," which I have communicated to this Society, I propose to resume my account of the Howietoun experiments from November 1884 until the present time. This period has been most instructive, as comprising the period during which the ova of the hybrids have been incubating; it has also demonstrated that we must not be too confident, should the eggs of two-year-old fish fail to hatch, that such failure is not due to the immaturity of the parents.

Respecting the hybrids between the Lochleven-Trout eggs and Salmon-smolt made December 24, 1881, those fish which have remained in the Octagon pond at Craigend[1] do not appear to have bred, neither have they much increased in size. On February 12 one was taken with a fly: it measured $9\frac{1}{2}$ inches in length, was in fair condition, and on being opened proved to be a barren male. Its form was similar to what I have previously described these fish to be. There were seven large black spots on the opercles on the right side and eight on those of the left; a row of red spots along the lateral line and a second series above it. Fins edged anteriorly with white, the dorsal with several irregular rows of black spots. A slight appearance of par-bands when in certain lights. Taken in conjunction with the largest similarly bred hybrid two years older than this lot, which was found in November 1884 to be merely $16\frac{1}{2}$ inches long[2], the supposition is raised that the breed may be a dwarfed one.

The young hatched in 1884 from Lochleven-Trout eggs and young Salmon-par, which produced "dropsies,"[3] are still in one of the large boxes at Howietoun. The water was too discoloured to allow of their being visible: a few were obtained by means of a landing-net; but they do not appear to have much increased in size.

The first experiment made with the eggs of a Grilse[4], which had been reared from eggs hatched at the Howietoun fishery, was on November 7, 1884, when about 100 were obtained by Mr. Thompson from one of these fish that had jumped out of the pond, and which were milted from a Lochleven Trout. On January 3, 1885, 18 hatched; and when I saw them on February 10 they were looking very well, and none of them appeared to be suffering from any deformities. Particular attention must be drawn in this place to the age of the Grilse, which had been hatched early in 1881 from ova and milt obtained from the Teith in December 1880. The fact of these young fish being in their third winter season has probably much influence on the success of their hatching.

Prior to discussing the results of incubation in the ova of the

[1] Proc. Zool. Soc. 1884, p. 584.
[2] *L. c.* p. 584.
[3] *L. c.* p. 583.
[4] *L. c.* p. 582.

rising two-year-old hybrid fishes, a very important fact must not be overlooked. Last season, 1883–84, it was observed that, although young Salmon-par at just over two years of age could fertilize the ova of Trout, the alevins were dropsical, and only about 100 out of 4000 survived. So the experiment was altered this season; and a young Lochleven Trout rising two years of age was employed to supply the eggs which were milted from an adult of her own race.

November 13, 1884.—About 500 eggs were obtained from a rising two-year-old Lochleven Trout, their average size being 0·17 of an inch in diameter (at 8 years old they are from 0·20 to 0·24 of an inch); these were impregnated from a male of average size and of the same race. The eggs were placed in box 124 *b*; and it was observed that besides being small, they had a much thinner shell than had those of older fish. The eggs did very badly, and only about a dozen hatched. This experiment is of very great value, as tending to show that small eggs taken from young mothers have a deficiency of vitality in a similar manner to the milt of the young males.

On December 9, 1884, about 400 ova were taken from a Howietoun Grilse and milted from a Lochleven Trout. The diameter of the eggs was 0·22 inch; and they were placed in tray 108 *b*. Only about half the eggs appear to have been impregnated.

December 13.—500 eggs were obtained from a dead Sea-Trout which had met its death from direct injury, a wound having extended into the ovary, and possibly water had then obtained entrance. To these eggs the milt of a Salmon par, reared at Howietoun, was added; and they were deposited in box 84 *c*. The size of the eggs was 0·18 inch in diameter. Probably none will hatch.

December 13, 1884.—650 eggs were obtained from a Sea-Trout, and having been impregnated from a Lochleven, they were placed in tray 84 *b*. The size of each egg was 0·18 inch in diameter.

November 11, 1884.—About 12,000 eggs of the Lochleven Trout were milted from a Howietoun-reared smolt, and laid down in box No. 1. These eggs have done very well, only about 87 dead ones having been picked out; they hatched on January 28, and the young look well. In this experiment neither parent was under the third season.

November 14, 1884.—About 800 eggs of the Lochleven Trout were milted from three Howietoun-reared pars and smolts. These eggs were placed in box 96 *a*. They hatched on February 5; the young are numerous, and appear to be very healthy. The remark on the age of the parents in the last experiment also may be applied to this.

On November 12, 1884, 1350 eggs of a Lochleven Trout were milted from a hybrid Char and Trout [1], this hybrid being 8½ inches in length. The eggs were placed in box 92 *a*; only about 12 eyed, and out of these 3 embryos came to their full size, but had not sufficient vitality to burst their shell, dying unhatched. As a rule, the eggs appeared not to have been impregnated. On measuring

[1] Proc. Zool. Soc. 1884, p. 586.


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